to present the whole series of experiments from which he drew his conclusions, while in the repeated experiments of Basile and Punnett all results were tabulated. This unscientific attitude seems to pervade the whole of Russo's work, and so long as his methods are thus at fault, it is not worth while to consider the bearing of his results, particularly in the face of direct contradiction by other investigators going over the same ground.

Finally the enquiry concerning the possibility of reversing the operation of Mendelian dominance in cross breedings may be considered. Here again we have to do with faulty experimental methods. Russo claims to be able to make white dominant over black in the first generation of hybrids by treating the white mother with lecithin injections before breeding, but practically no attempt is made to analyze the racial composition of the animals used in breeding. Such experiments as he presents in support of this contention would have no standing whatever with experienced breeders and it may be said without any exaggeration that in such a presentation of his case he has forfeited entirely the serious consideration of his work. A detailed analysis of this part of his studies has been recently given by Castle[5] and will not be repeated here. It is much to be regretted that an extended investigation like this of Russo's should be vitiated by untrustworthy methods, for such lines of work need following out and are extremely valuable in furthering an analysis of the relations existing between the germ cells and the parental bodies. That the author will present his work purged of the serious errors it now contains must be the hope of all his fellow workers.

C. E. McClung

Factor Tables for the First Ten Millions, containing the smallest factor of every number not divisible by 2, 3, 5 or 7 between the limits 0 and 10,017,000. By Derrick Norman Lehmer. Washington, D. C., Carnegie Institution of Washington, Publication No. 105. 1909. Pp. xvi + 476. Price $20.

The publication of the best and most extensive work in any language, on an old and important subject, is eminently worthy of recognition, especially when the preparation of such a work demanded the most painstaking care and unselfish devotion to the interests of science. Prime numbers and factors of composite numbers are among the oldest as well as among the newest objects of study in mathematics. The perennial interest in these subjects bears testimony to their importance and helpfulness in our efforts towards stronger instruments of thought and towards a more rational intellectual penetration into the physical laws which we encounter on all sides.

While it may be true that integral numbers do not occupy comparatively as large a place in our present mathematical thinking as they once did, they still constitute, according to Minkowski, "the fountain-head of all mathematics" and they enter prominently into many of our mental processes. We are not infrequently brought to questions whose solutions are expedited by a knowledge of the existence of primes or of the factors of large composite numbers. Under such circumstances one will naturally turn hereafter to the tables before us with an unusual confidence in their correctness and a high appreciation of their great extent.

The pages of the present table are very large —about sixteen inches long and twelve inches wide. "Each horizontal line of the table covers 210 numbers. The multiples of 2, 3, 5 and 7 are not listed. As there are 100 lines on each page it follows that each page will serve to find the smallest factor of 21,000 consecutive numbers. The largest and smallest of these are given at the top of the page. These numbers then indicate at a glance the page that contains the smallest divisor of the given number." To find the smallest factor of a given number without the aid of an auxiliary table, it is necessary to divide the number by 210 and to locate the quotient and the remainder in the table. By means of these two numbers it is very easy to find the smallest factor of the number in question, if it is composite but not divisible by 2, 3, 5 or 7. The division by 210 may be avoided by means of an auxiliary table.

In his preface the author states that "The

[5] *Loo. cit.*

Carnegie Institution of Washington has for five years furnished the funds necessary for the preparation of the manuscript and for the publishing of the tables." He also acknowledges gratefully sufficient temporary relief from academic work in the University of California to afford opportunity to devote more of his time to the arduous task of most careful proof-reading, for errors in such work are not suggested by the context, and the author wisely observes that "the value of a factor table depends chiefly on its freedom from errors."

The introduction includes a valuable list of corrections to earlier extensive tables and directs attention to "the manuscripts of Kulik which were placed in charge of the Vienna Royal Academy in 1867. These tables were said to give the smallest factor of all numbers not divisible by 2, 3 or 5 up to the limit of *one hundred million!*" The author of the present table saw only the first one of the six volumes of Kulik's manuscript, and furnishes a rather extensive list of errata in the tenth million. He also includes, in the introduction, a short historical account of the earlier factor tables as well as some remarks on the methods of constructing such tables. In every way the present table appears to deserve a very high place among the American mathematical publications of permanent value, and both the author and the Carnegie Institution have rendered a great service not only to the mathematical public but also to many who make only occasional use of mathematics.

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SHACKLETON'S CONTRIBUTION TO BIOGEOGRAPHY

IT has long been surmised that certain south polar lands may have one time connected several of the main biogeographic regions of the earth. Wilkes Land, South Victoria Land and Graham Land, with other near-by lands more recently named, have been conceived as forming a continent, which in times past may have stretched its shores to connections with the other continents of the southern hemisphere. Shackleton's recent work in Antarctica has now placed the existence of that continent in the realm of fact. Surmise has given way to certainty. We are now in position to deduce certain conclusions from its existence and the known conditions pertaining to it. In the hope of stimulating discussion of the general subject by those more versed in paleogeographic data than myself, I venture to state the following aspects of Shackleton's discoveries as they appear to the student of geographical distribution.

During past geologic ages, with the exception of certain relatively brief intervals of change, Antarctica has, in common with the rest of the globe, enjoyed comparative freedom from ice, excepting only the presence of alpine glaciers, and been blessed with an equable temperature. In those days the wide-stretching south polar land comprised an immense continent whose thousands of miles of extent were for the most part quickened by a mild climate and populated with an abundant life. Here during Paleozoic, Mesozoic and Tertiary time was a wonderfully rich territory, its resources now practically lost to us under an all-pervading ice-sheet. Shackleton's party found evidence of extensive coal deposits, including remains of forested areas, indicating an abundant flora and fauna. Let us see what light the former existence of such favorable biotic conditions throws on the present distribution of life with reference to Australia, South America and Africa.

Australia and New Zealand, occupying approximately longitude 110° to 180° east from Greenwich, are almost opposite the southern extremity of South America, which is about longitude 70° west from Greenwich. The southern limits of Australia and New Zealand are in latitude 40° to 50° south, those of South America in latitude 55° south. Thus there intervenes between these present land divisions an actual distance of only 75° to 85° by way of the south pole. The straight-away line between the centers of the two masses passes well to one side of the pole, and the intervening distance between their southern limits, but practically across the heart of the south polar region, may be roughly stated as 4,500 geographic miles. The southern ocean soundings so far made reveal shallow depths, or epi-